with the corresponding values of polar diameter

from 1880–1892	...	...	...	37″·03
1893–1901	...	...	...	36·54

The results of this discussion exhibited in a tabular form are as follows :

Included Oppositions.	Equatorial Diameter.	Polar Diameter.
1880–1892	38″·84	37″·03
1893–1901	38·07	36·54
1880–1901	38·54	36·84

Report on Observations of Jupiter for 1903–4.

By Major P. B. Molesworth, R.E.

Part I. Preliminary.

Place.—Trincomali, Ceylon. Longitude east, $5^h\ 24^m\ 55^s{\cdot}6$; latitude north, 8° 33′ 24″·2. Observatory ninety-one feet above mean sea level.

Telescope.—Calver silver on glass Newtonian ; $12\frac{3}{4}$-inch aperture ; ninety-two inches focus, equatorially mounted with driving clock. The eyepieces generally employed were a Huyghenian of 230 and a Steinheil monocentric of 270.

Nomenclature.—The nomenclature I have adopted has been in use here for several years, but differs slightly from the one generally used. A diagram is given on p. 700, showing the identification of each portion of the planet. In addition to the name, a letter is allotted to each zone and belt for identification, and these are qualified by the symbols N = North, S = South, C = centre.

Scope of the Observations.—These were begun on 1903 April 21, and continued before dawn till 1903 July 30. They were continued in the evening from 1903 August 18 to 1904 February 23. They thus cover an inclusive period of 310 days, on ninety-five of which I was absent from Trincomali ; so that 215 nights were available. One hundred and forty-one of these (65·6 per cent.) were utilised, and the planet observed for central meridian transits for a total period of 287 hours ; an average of two hours four minutes per working night. Five thousand six hundred and fifty-one C.M. transits were taken, an average of nearly twenty an hour. Eight sets of measures were also made for latitude.

Colour estimations of the different belts were made on ninety-six nights. Satellite phenomena were observed on sixty-

eight nights, and careful satellite comparisons made on ninety-nine nights.

Measures.—Made with a bifilar position micrometer by Calver. Generally used with a Barlow lens, giving a screw value of 2·500. Powers 150 without the "Barlow," and 205 and 280 with it. They were generally made in daylight on account of the unsatisfactory illumination of the micrometer. Results are given in a separate table (Table II.).

Method of Observation.—The method of observation employed was that suggested by Stanley Williams in his *Zenographical Fragments*, except that in no case was any longitude worked out till the whole of the observations for the night were completed and booked. This was done to avoid any bias.

Publication of Results.—The publication of the results has been greatly delayed by ill-health, absence in England, and pressure of other work.

Part II. Disc Observations.

General description of the features noted in the various zones and belts from south to north.

(*AA*). *S. Polar Region.*—Generally a very faint brownish grey slightly striated under the best conditions of definition. The N. edge is slightly darker than the rest, and contains some very indefinite streaks. The rotation period of these is very uncertain.

(*A*) *S.S. Zone.*—Generally the faintest of the zones, but here and there containing brighter spots. Two of these were very well observed in λ262° and 38°, and were unusually brilliant objects for this latitude. Their deduced periods were $9^h\ 55^m\ 04^s{\cdot}77$ and $9^h\ 55^m\ 05^s{\cdot}94$ respectively, showing that they were involved in the same current as the material of the S. Temperate Belt (B). This is, I think, the first reliable determination of the period of white spots in this latitude.

(*B*) *S. Temperate Belt.*—Very faint grey; abnormally faint this year to my eye, containing some fairly dark streaks, the ends of which are rather diffuse. The mean period $9^h\ 55^m\ 06^s{\cdot}35$ is, I think, reliable. Five fairly well marked spots, however, between λ146° and 272° showed a considerably slower average period ($9^h\ 55^m\ 12^s{\cdot}25$). This is my first observation of spots with an abnormal period in this latitude.

(*C*) *S. Temperate Zone.*—As a rule not very bright, but containing some brilliant spots. Some of these, as Denning has recently pointed out (*Observatory*, 1904 September, page 345), possess a very considerable degree of permanence. These two spots have been well observed independently here. I have combined Denning's published results with my own, and the agreement is very close indeed. The average period for the zone is $9^h\ 55^m\ 19^s{\cdot}03$, rather slower than in previous years but, I think, perfectly reliable.

(*D*) *S. Tropical Belt.*—The darkest and most distinct of the minor belts; decided slate grey with sometimes a faint tinge of blue. It contains some very dark streaks, generally broad and knotted, and sometimes double, but more rarely double this year than usual. The average period ($9^h\ 55^m\ 18^s{\cdot}45$) is much the same as that of the S. Temperate Zone. It varies little from year to year and may be taken as reliable.

The Red Spot.—Practically unchanged in recent years. The breadth of the bay remaining fairly constant throughout the observations. The S. Equatorial Belt remains widely double and rather faint for some distance preceding the bay. The preceding shoulder is generally very faint and slightly rounded, the following shoulder very dark and pointed. A curved wisp is generally seen to join the latter with the S. Tropical Belt a short distance preceding it. On rare occasions a very faint similar wisp has been noted from the preceding shoulder, completing the oval of the Red Spot Bay. The bay is shallow but symmetrical. The Red Spot is very faint, like a faint grey stain with a slight tinge of brown under the best conditions, when the whole outline can just be made out. The ringed appearance is not so prominent as in recent years. Once or twice a very faint diffuse horizontal streak was seen crossing the spot in a line between the shoulders, but not extending the full width of the bay. The following end of the spot is slightly darker than the rest. The period for the first part of the apparition was rather more rapid than usual ($9^h\ 55^m\ 39^s{\cdot}55$), but about 1903 August 18 it slowed down to $9^h\ 55^m\ 42^s{\cdot}30$. The mean period was $9^h\ 55^m\ 41^s{\cdot}19$.

Great S. Tropical Dark Area.—One of the most striking features of the apparition, preceded and followed by two very brilliant white spots. The motion of the centre of the area was fairly uniform with a mean period of $9^h\ 55^m\ 21^s{\cdot}83$, but the length of the shade increased from about 29° of longitude on 1903 April 25 to nearly 50° on 1903 July 29. After this it remained fairly constant till near the end of the observations, when it again appeared to increase. The first increase of length seems to have been due to a retardation of the following end, while the second was due to an acceleration of the preceding end. Under good definition it presented a very curious appearance, being made up of numerous smoky wisps, springing from knots in the S. edge of S. Equatorial Belt. There were several darker condensations in it, and a dull white patch near its centre. The average period of the preceding end was $9^h\ 55^m\ 19^s{\cdot}43$, and of the following end $9^h\ 55^m\ 24^s{\cdot}23$, giving an average period for the centre of $9^h\ 55^m\ 21^s{\cdot}83$. It was nearing conjunction with the Red Spot when the observations ended.

(*E*) *Other Spots in S. Tropical Zone and S. Edge of S. Equatorial Belt* (Fs).—The S. Tropical Zone was generally bright milky white, not much inferior to the Equatorial Zone. It is crossed by several faint wisps. The spots in this zone appear to

have been considerably retarded in period compared with previous years. The average being $9^h\ 55^m\ 48^s{\cdot}47$.

(*F*) *S. Equatorial Belt.*—Much the most prominent of the belts, dark and distinct throughout, but showing a decided change of tint. Early in the observations it was a warm bluish purple; warmest just following the Red Spot Bay, and bluest in the darker parts of the N. edge. This gradually changed to a brownish purple in August, the brown tint growing more decided as time went on. The *S. edge* was very dark and clean-cut, showing the same slight tendency to the formation of shallow white bays that I have noticed in previous years. The *centre* of the belt was nearly always rifted, the rift (especially in June) having sometimes a decided yellow tinge. The period of the white spots in it was found to be $9^h\ 51^m\ 27^s{\cdot}19$ this year, showing a progressive acceleration in period of about five seconds per annum when compared with the results for 1901 and 1902–3.

The *N. edge* is more regular than the S. edge, and is much knotted and disturbed. The motion of the dark projecting knots is not uniform, and both these and the white spots in S. edge of Equatorial Zone sharing their motion are very hard to follow, correct identification being very difficult. The deduced average period ($9^h\ 50^m\ 22^s{\cdot}72$) agrees well with my results for previous years, though these differ somewhat from those obtained by Denning and Phillips.

(*GK*) *Equatorial Zone.*—Generally very white with no trace of yellow, the brighter spots being an almost phosphorescent white. After July the brightness of the *S. edge* (G) faded considerably and became slightly shaded (the motion of this is dealt with under S. Equatorial Belt). The *N. edge* of the zone (K) was very bright throughout, always the brightest part of the disc. The brightness was remarkably uniform, and its regularity was shared by the S. edge of N. Equatorial Belt.

This region is always subject to great variations, probably cyclical, the markings being sometimes as frequent and well marked as those of the S. edge of Equatorial Zone, while at other times they completely disappear. I cannot say whether this is due to an actual cessation of activity in the spots themselves or to the interposition of some obscuring medium between our eye and the strata in which the spots occur. It appears to vary in some way with the breadth and distinctness of the N. Equatorial Belt.

(*L*) *N. Equatorial Belt.*—Its appearance in 1903–4 was most peculiar. A faint orange band was visible throughout in its position, on the *S. edge* of which lay a very narrow dark uniform purple band, containing practically no darker knots or condensations. The tint of this S. streak grew gradually warmer and browner towards the end of the apparition. Along the *N. edge* of the faint orange band was a very faint streak, continuous on the finest nights, but generally barely traceable. Here and there in this streak were short intensely dark portions, sharp and well

defined, but fading later in the apparition. Their period ($9^h\ 55^m\ 29^s{\cdot}90$) agrees well with previous years, but as usual there are traces of abnormally rapid period in a few spots.

(*M*) *N. Tropical Zone.*—Always whitest along its N. edge, where it was sometimes very bright; but the general tint was brownish yellow, browner and yellower to S. A few diffuse white spots were seen early in the apparition in the northern part of the zone, but faded very much as time went on. Their period is remarkably uniform, and is identical with that of the short dark streaks in N. edge of N. Equatorial Belt, with which they are obviously connected.

(*MM*) *N. Tropical Belt.*—A decided bluish-grey belt having at times a peculiar, almost mauve, tinge. Some of the streaks in it are certainly double. It joins the S. edge of a very faint grey shade which extends to the N. pole. The motion of the markings in it, as in recent years, was very irregular. The mean period ($9^h\ 56^m\ 01^s{\cdot}94$) is very slow, but agrees well with the figures obtained in 1899 and 1900. The period in different years appears to depend on the varying latitude of the belt.

(*NN*) *N. Temperate Zone.*—More variable in brightness than any of the other zones. The brighter patches being vague and nebulous, with the exception of two fairly distinct spots in $\lambda 343°$ and 359°. The average period ($9^h\ 55^m\ 56^s{\cdot}11$) agrees well with previous results and appears reliable.

(*N*) *N. Temperate Belt.*—Faint bluish, generally greyer in tint than N. Tropical Belt. The spots in it give an average period of $9^h\ 55^m\ 41^s{\cdot}05$, but their motion is very irregular. The measures show a considerable displacement in latitude to the N. late in the apparition, which may account for this irregularity.

(*P*) *N.N. Zone.*—Faint and nebulous, but fairly uniform. The periods obtained for this zone in different years do not agree, and cannot be regarded as reliable.

(*Q*) *N. Polar Region.*—Generally slightly striated, with a faint bluish tinge, the S. edge being rather the darker. The mean period for spots in it is $9^h\ 55^m\ 21^s{\cdot}49$, agreeing with that obtained in 1900, but differing considerably from that for 1901. Just inside the darker border of the polar regions is a very faint zone (R), and a very faint diffuse belt (S) further N. No results could be deduced from the scattered observations of spots in these latitudes.

General Tint of Planet.—The general tint in 1903–4 was unusually white, with hardly any trace of yellow. Even with the naked eye the planet seemed a paler yellow than usual.

Relative Brightness of Zones.—The relative brightness of the various zones was noted each night, the brightest zone being numbered 1 and the others in order. A rough measure of the relative brightness has been obtained by adding all the "points"

together and dividing by the number of observations. The results are as follows :—

K.	N. edge of Equatorial Zone	1·02
G.	S. „ „	2·10
E.	S. Tropical Zone	2·88
M*n*.	N. edge of N. Tropical Zone	3·48
NN.	N. Temperate Zone (very variable) ...	4 66
C.	S. Temperate Zone	5·25
P.	N.N. Zone	6·37
A.	S.S. Zone	8·00

Measures.—Six sets of measures were made in 1903 May and three in December. The results in each case are reduced to distance from the centre at mean distance of *Jupiter* (5·20). The means of each group are then reduced to apparent latitude and corrected for the tilt of axis. In the reduction no account has been taken of polar compression, the formula employed being $\sin \phi = d/r$ where d = distance from centre and r = polar radius of *Jupiter*.

The result of a careful eye estimate of the latitude of the belts is also given, and the mean latitudes worked out at the foot of the Table (Table 2).

The results call for no remark, except as regards the progressive increase in latitude of the N. Temperate Belt.

Part III. Satellites.

Careful observations were made with a view of determining the relative brightness, albedo, colour, and variability of the four larger satellites. The convention adopted was to number the satellites each night in order of brightness on a rough diagram, with the addition of the symbols + and − (+ signifying that the satellite in question was very much brighter than the next in order—only very slightly brighter).

Relative Brightness.—A measure of this was obtained by adding up the total points for each satellite and dividing by the number of observations. The average relative brightness is as follows :

iii. = 1·00 i. = 2·09 ii. = 2·75 iv. = 3·93

Size.—On 1903 May 12 I made a careful comparison of the relative diameters of the discs with power 370. Taking that of i. as unity, I made them

i. = 1·0 ii. = 0·8 iii. = 1·4 iv. = 1·25-1·30

This agrees fairly with Barnard's measures (*Monthly Notices*, vol. lviii. p. 217)

i. = 1″·048 ii. = 0″·874 iii. = 1″·521 iv. = 1″·430

Albedo.—ii. has a peculiar sheen and almost sparkles, with evidently a very high albedo. I never remember a case of a dark transit of this satellite.

i. has a soft steady light, but is decidedly less reflective than the centre of *Jupiter*, generally grey in mid-transit.

iii. shines with a very soft, equable light, like i., but its albedo is decidedly lower; as it is grey for the greater part of its transit, even in high latitudes, and very dark at mid-transit.

The albedo of iv. is very low indeed, and its surface seems slightly less reflective than the limb of *Jupiter*. It appears grey directly after transit ingress, and is almost black at mid-transit.

Colour.—The average colours to my eye are:—i. very pale yellow, with sometimes a faint rosy tinge; ii. more decided yellow than i.; iii. very pale primrose yellow paler even than i.; iv. bluish or purplish when faintest, greyish white when brightest.

Variability.—Very difficult to estimate. iv. and ii. appear to have the greatest range; i. only very slightly variable; iii. remarkably uniform.

Effect of glare, &c.—iv. and ii. also appeared more affected by twilight and the glare of the planet, and also by haze and cloud, than the other two (a curious result, considering their utter dissimilarity in size, albedo, and colour).

To sum up, if we use the same convention I have adopted for the satellite comparisons, the relative values come out as follows:—

General brightness: iii. (1+); i. (2—); ii. (3); iv. (4).

Albedo: ii. (1+); i. (2—); iii. (3+); iv. (4).

Size: iii. (1); iv. (2+); i. (3); ii. (4).

Colour: iii. palest yellow; i. pale yellow; ii. yellowest; iv. bluish.

Variability: iv. (1); ii. (2+); i. (3—); iii. (4).

Affected by glare, &c.: iv. (1); ii. (2+); i. (3); iii. (4).

An earlier comparison of mine is given in *B.A.A.J.* (ix. 432).

Apparent Elongation of i.—The apparent elongation of i. in transit near ingress and egress was repeatedly noticed. The phenomenon is most marked at ingress. It is certainly due to the higher albedo of the equatorial portion of the satellite disc (*Mem. B.A.A.* vii., iv. 99).

Eclipses of ii.—The somewhat rare phenomenon of an eclipse of ii. just clear of occultation was seen on three occasions in 1903. On June 6 the observed interval between Ec.R. and Oc.D. was $2^m\ 55^s$ against $1^m\ 06^s$ predicted in *N.A.* On December 1 the observed interval between Oc.R. and Ec.D. was $4^m\ 58^s$ against $1^m\ 37^s$ predicted, and on December 8, $6^m\ 05^s$ against $3^m\ 29^s$ predicted; so that the observed times in every case were considerably in excess of the predicted times.

Webb (*Celestial Objects*, i. 180) speaks of only four instances being on record. This is surely a mistake, as I think I have myself witnessed eight or ten cases.

Markings on iii.—Markings were seen on the disc of iii. during transit on several occasions. If the satellite is carefully watched just as it appears to turn grey, the equatorial markings can be distinctly seen, if the conditions are good, with a power of 400 or 450.

Distortion of Shadows near Quadrature.—The distortion of the shadows at ingress and egress near quadrature was well seen on several occasions. In poor seeing the effect of the E.–W. elongation is to make the shadow appear larger and darker, while the reversed conditions make it seem very small and faint. In good air, however, the elongation can be distinctly seen, but hardly seems to attain the magnitude demanded by theory.

Part IV. General Remarks.

Cyclical Variation in Period.—If the spots in any zone are plotted on a diagram in which the verticals give dates, and the horizontal longitudes, even the most distinct and best observed ones will be found to deviate considerably from the straight line which represents their mean motion. Part of this deviation is certainly due to errors in observation, but not all. If the O—C residuals are worked out for each observation, they will be found to have a gradually increasing + value for some time up to a maximum, after which they will gradually decrease to a negative maximum, returning again to the zero line. This is particularly striking in the cases where I have incorporated some of Mr. Denning's results (*Obs.* 1904 September) for S. temperate spots with my own. I have worked out the residuals for both observers, and Mr. Denning's observations almost invariably confirm mine, while his residuals have the same sign and approximately the same magnitude as those of my observations made about the same time. These are in many cases far too large to be due to errors of observation.

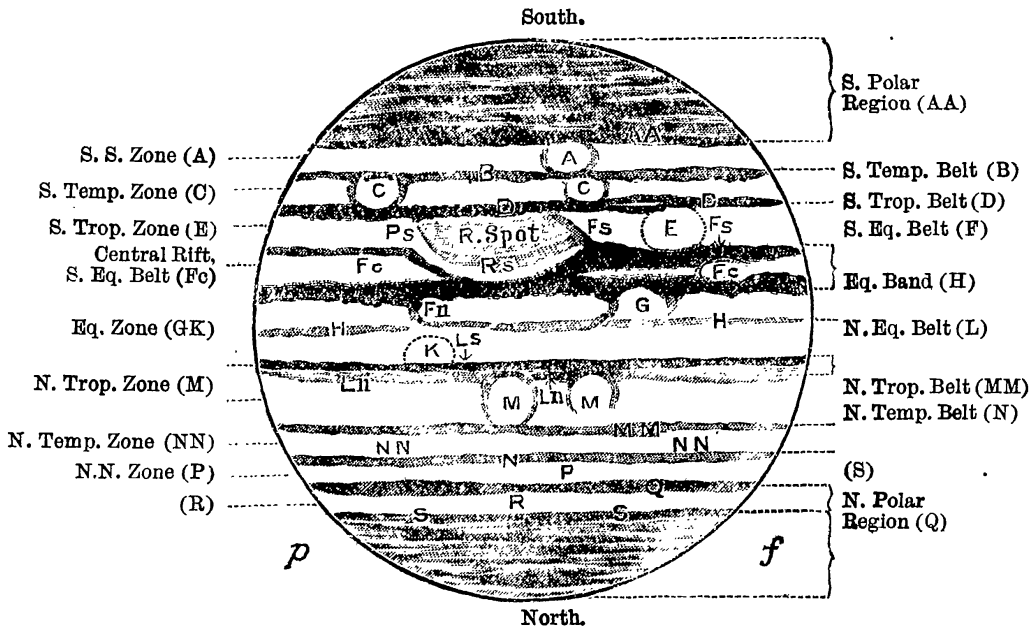
In the hope of obtaining some clue to the causes governing this variation, I worked out the O—C residuals for the whole of my observations of system ii. spots. This has entailed an enormous amount of work and delayed the publication of results, but has led to practically no result.

There is an unmistakable cyclical "swing" in period, of variable magnitude and duration; but I cannot determine its cause, or the laws which govern its action. It may possibly be due to tidal action of the four larger satellites, the apparent irregularity depending on the varying configurations of the four. I should be very glad if some one, with more leisure and mathematical ability than I have, would thoroughly investigate the question. My observations would, I believe, give sufficient data to work on, and I should be delighted to place them at his disposal. A few years ago, from the movements of the two shoulders of the Red Spot Bay, I was led to strongly suspect a period of ± 90 days between maximum variations, but I have been unable to confirm this since.

Possible Extension of the Atmosphere of Jupiter.—I have carefully studied the behaviour of the satellites this year when close to *Jupiter*. The glare of the planet undoubtedly affects the brightness of the satellite considerably, and the different satellites are affected in different degrees. Estimations of this sort are particularly liable to error, but the observations this year confirm those of previous years, and tend to show that the satellites are very much fainter near occultation than when in similar positions with respect to *Jupiter* near transit, often losing fully half their light. The difference is most striking with ii. Near transit this satellite is very brilliant, but near occultation seems often hardly brighter than the limb. The evidence is rather conflicting, but seems to point to the existence of an invisible atmosphere round the planet, which extends some distance from the apparent limb. The idea is not new, and the explanation seems rational when we consider the probable high temperature of the planet.

Visibility of the Red Spot Bay.—For several years I have made a practice of noting the visibility of the Red Spot bay at varying distances from the C.M. when coming on and passing off. The observations agree very well, and tend to show that the following shoulder is more easily visible coming on than passing off, while the reverse is the case with the preceding shoulder. Coming on, the following shoulder is visible under favourable conditions when 70° of longitude from the C.M.; while passing off it has already begun to be very nebulous and indistinct before it reaches 60° from the C.M. The preceding shoulder, on the other hand, is very hard to see coming on until less than 50° from the C.M.; while passing off it can sometimes be traced almost to the limb, and clearly to 65° or more of longitude from C.M. The shade of the Red Spot itself is more apparent when coming on and going off than when it is actually on the central meridian. This latter phenomenon is possibly due to the surface of the spot consisting of slightly roughened cloud masses, which introduce slight shadow effects when obliquely lighted, thereby increasing the apparent darkness of the spot. When near the C.M. the illumination would be

nearly vertical, and the shadow effects would disappear. I append a diagram showing the nomenclature adopted and two tables



NOMENCLATURE DIAGRAM.

TABLE I.

Rotation Periods in Different Zones for the Six Years 1898 *to* 1903–4.

Belt or Zone.	No. of Spots.	Average No. of Rotations.	Average No. of Observations.	Period.	No. of Spots.	Average No. of Rotations.	Average No. of Observations.	Period.	No. of Spots.	Average No. of Rotations.	Average No. of Observations.	Period.
		1898.		h m s		1899.		h m s		1900.		h m s
(AA)	...	...	...	...	...	...	...	...	8	220	7·4	9 55 32·24
(A)	...	...	...	...	...	...	...	...	8	433	7·7	9 55 22·21
(B) ...	4	116	4·2	9 55 5·91	3	105	3·3	9 55 5·60	21	508	14·5	9 55 6·60
(C) ...	3	128	6·0	9 55 14·63	5	109	3·4	9 55 15·87	22	498	15·4	9 55 16·54
(D) ...	3	70	2·6	9 55 15·17	15	167	5·5	9 55 16·01	24	510	17·8	9 55 17·22
(E) ... (Fs) ...	...	...	...	...	1	206	12·0	9 55 41·89	12	560	26·9	9 55 41·92
R. Spot	3	257	18·0	9 55 40·63	3	262	15·0	9 55 42·01	3	693	42·6	9 55 41·53
G. S. T.	...	...	...	...	...	...	...	...	...	...	...	...
(FC)	...	...	...	...	5	137	3·8	9 54 44·56?	13	440	8·1	9 51 37·30
(Fn) ... (G) ...	...	...	...	...	42	194	6·3	9 50 23·06	46	585	23·8	9 50 22·36
H)	...	...	...	...	8	159	3·4	9 50 29·94	13	505	14·6	9 50 25·23

"G. S. T." = Great South Tropical Dark Area.

Belt or one.	1898. No. of Spots.	1898. Average No. of Rotations.	1898. Average No. of Observations.	1898. Period. h m s	1899. No. of Spots.	1899. Average No. of Rotations.	1899. Average No. of Observations.	1899. Period. h m s	1900. No. of Spots.	1900. Average No. of Rotations.	1900. Average No. of Observations.	1900. Period. h m s
K) ... Ls) ...	...	...	...	...	...	...	...	...	22	614	15·0	9 50 29·04
Lc)	...	...	...	...	10	183	5·0	9 55 35·01	10	562	25·1	9 55 29·18
Ln) ...	6	196	11·1	9 55 26·67	21	171	6·7	9 55 30·83	20	612	35·0	9 55 30·47
M) ...	...	...	...	...	...	...	...	...	6	646	39·5	9 55 21·46†
MM) ...	...	...	...	...	6	123	4·5	9 56 6·41	13	496	17·1	9 56 0·21
NN) ...	...	...	...	...	...	...	...	...	5	307	7·2	9 55 58·97
N) ...	2	123	7·0	9 55 50·65	5	173	4·4	9 56 17·54?	14	430	11·0	9 55 37·92
P)	...	...	...	...	...	...	...	...	5	284	5·8	9 55 35·21
Q)	...	...	...	...	...	...	...	...	4	517	12·7	9 55 19·12

Belt or one.	1901. No. of Spots.	1901. Average No. of Rotations.	1901. Average No. of Observations.	1901. Period. h m s	1902–3. No. of Spots.	1902–3. Average No. of Rotations.	1902–3. Average No. of Observations.	1902–3. Period. h m s	1903–4. No. of Spots.	1903–4. Average No. of Rotations.	1903–4. Average No. of Observations.	1903–4. Period. h m s
AA) ...	4	421	6·2	9 55 22·75	...	...	...	...	4	432	52·0	9 55 14·24
A) ...	5	380	7·2	9 55 19·88	1	567	4	9 55 36·95?	2	593	16·0	9 55 5·16
B) ...	21	525	11·2	9 55 6·14	3	635	7·7	9 55 4·01	9	569	16·0	9 55 6·35
									5	649	16·6	9 55 12·25†
C) ...	22	526	12·3	9 55 18·26	2	142	6·5	9 55 18·84	12	686	30·4	9 55 19·03
D) ...	25	514	12·0	9 55 17·76	7	564	7·3	9 55 17·88	17	658	27·6	9 55 18·45
E) ... Fs) ...	...	...	...	...	...	...	...	...	8	357	17·3	9 55 48·47
R. Spot	3	633	29·0	9 55 40·63	3	752	20·7	9 55 39·70	3	714	44·7	9 55 41·19
R. S. T.	1	611	29·0	9 55 19·33	4	689	18·0	9 55 14·42	4	716	49·5	9 55 21·83
					4*	540	...	9 55 21·15				
Fc) ...	20	492	9·6	9 51 32·29	...	...	...	...	16	599	10·4	9 51 27·19
Fn) ... G) ...	56	539	15·3	9 50 25·89	18	673	9·5	9 50 25·90	42	685	25·0	9 50 22·72
H) ...	9	464	7·0	9 50 27·98	...	...	...	...	18	552	7·6	9 50 24·89
K) ... Ls) ...	44	519	8·3	9 50 25·29	3	700	12·0	9 50 41·97	2	597	6·0	9 50 49·06?
Ln) ...	28	532	11·2	9 55 29·72	13	597	9·3	9 55 26·72	13	570	27·0	9 55 29·90
MM)	9	527	6·7	9 55 39·29?	2	434	7·0	9 55 50·76	11	495	13·2	9 56 1·54
NN)	2	570	7·0	9 55 56·27	...	...	...	...	18	545	9·7	9 55 55 11
N) ...	16	478	9·4	9 55 42·88	1	666	9·0	9 55 50 55	19	618	18·2	9 55 41·05
P) ...	13	477	7·7	9 55 37·80	...	...	...	...	12	478	7·9	9 55 39·93
Q) ...	21	458	8·4	9 55 39·66	...	...	...	...	11	411	11·6	9 55 21·49

"G. S. T." = Great South Tropical Dark Area.

* Intermediate period, 1903 January–April. † Abnormal.

Table II.

Measures 1903–4.

Date. 1903.	Approx. G.M.T.	Power.	Definition.	Approx. Longitude (System II.).	Distance from Centre at Mean Distance 5·20. Centre S. Tropical Belt (D).	S. Edge of S. Equatorial Belt (Fs).	N. Edge of S. Equatorial Belt (Fn).	S. Edge of N. Equatorial Belt (Ls).	N. Edge of N. Equatorial Belt (Ln).	Centre. N. Tropical Belt (MM).	Centre. N. Temperate Belt (N).	Polar Diameter. Observed (O).	Calculated (C).	O–C.	Reduced to Distance 5·20.	O–C.
				°	″	″	″	″	″	″	″	″	″	″	″	″
May 12	12·47	280	good to sharp	320	− 7·660	− 4·758	−2·310	+1·862	+ 3·698	+ 7·186	...	...	...	...	...	...
19	12·40	280	sharp	285	− 7·826	− 6·056*	−2·158	+2·009	+ 2·946	+ 7·160	+ 9·689	...	...	...	...	...
21	12·27	280	sharp, falling off	217	− 7·964	− 5·159	−2·759	+1·778	+ 3·570	+ 6·823	+ 9·482	36·02	35·66	+0·35	36·311	+0·366
25	12·40	280	„	108	− 8·620	− 5·090	−2·520	+2·040	+ 3·770†	+ 7·530	...	36·36	36·06	+0·30	36·241	+0·296
26	12·33	280	sharp	253	− 8·674	− 5·419	−1·990	+2·094	+ 3·552	+ 7·210	+10·111	36·47	36·22	+0·25	36·246	+0·301
27	12 40	205	sharp, falling off	48	...	− 4·730	−2·192	+1·702	+ 3·529	+ 7·262	...	36·71	36·39	+0·39	36·378	+0·433
May Observations (micrometer).			Means		− 8·149	− 4·934	−2·320	+1·914	+ 3·459	+ 7·195	+ 9·761			Mean ...	36·294	+0·349
			Apparent latitude ...		S. 26°97	S. 15°93	S. 7°42	N. 6°12	N. 11°10	N. 23°60	N. 32°90					
			Correction to centre (B)		+ 1·52	+ 1·52	+1·52	+1·52	+ 1·52	+ 1·52	+ 1·52					
			True latitude (ϕ) ...		S. 25·45	S. 14·41	S. 5·90	N. 7·64	N. 12·62	N. 25·12	N. 34·42					
Dec. 1	0 00	280	good, improving	″ 115	− 8″220	− 5″800‡	−2″790	+1″560	+ 3″380	+ 7″030	...	38″93	39″28	+0″35	35″621	−0″324
7	0·00	205	„	297	− 8·290	− 4·626	−2·431	+1·717	+ 3·910	+ 8·279	...	38·45	38·51	−0·06	35·888	−0·057

* In dark area. † Detached streak. ‡ Near dark area.

Date. 1903.	Approx. G.M.T.	Power.	Definition.	Approx. Longitude (System II.).	Distance from Centre at Mean Distance 5·20.							Polar Diameter.				
					Centre S. Tropical Belt (D).	S. Edge of S. Equatorial Belt (Fs).	N. Edge of S. Equatorial Belt (Fn).	S. Edge of N. Equatorial Belt (Ls).	N. Edge of N. Equatorial Belt (Ln).	Centre. N. Tropical Belt (MM)	Centre. N. Temperate Belt (N).	Observed (O).	Calculated (C).	O–C.	Reduced to Distance 5·20.	O–C.
				°	″	″	″	″	″	″	″	″	″	″	″	″
Dec. 19	0·05	205	good, improving	302	− 8·822	− 4·932	−2·384	+2·063	+ 3·751	+ 8·308	+12·228?	37·08	37·07	+0·01	35·954	+0·009
		Means			− 8·444	− 5·119	−2·535	+1·780	+ 3·680	+ 7·872	+12·228?			Mean ...	35·821	−0·124
December Obs. (micrometer).		Apparent latitude ...			S. 28°03	S. 16°55	S. 8°12	N. 5°68	N. 11°82	N. 25°97	N. 43°00					
		Correction to centre (B)			+1·61	+ 1·61	+1·61	+1·61	+ 1·61	+ 1·61	+ 1·61			Mean of both ...	36·091	+0·146
		True latitude (φ) ...			S. 26·42	S. 14·94	S. 6·51	N. 7·29	N. 13·43	N. 27·58	N. 44·61					

Date. 1903.	Approx. G.M.T.	Power.	Definition.	Approx. Longitude (System II.).	N. Edge of S. Polar Region (AA).	Centre of S. Temp. Belt (B).	S. Edge N. Polar Region (Q).
				°	″	″	″
Oct. 19	2·05	270 (eye estimate)	sharp	200	−13·520	−12·567	+13·397
October (eye estimate.)		Apparent latitude ...		S. 29·65	...	...	...	...	N. 25°37	N. 36°93	S. 48°68	S. 44°07	N. 48°24
		Correction to centre (B)		+ 1·77	...	...	...	...	+ 1·77	+ 1·77	+ 1·77	+ 1·77	+ 1·77
		True latitude (φ) ...		S. 27·88	...	...	...	...	N. 27·14	N. 38·70	S. 46·91	S. 42·30	N. 49·99
		Adopted Mean latitude ...		S. 25·93	S. 14°67	S. 6°20	N. 7°46	N. 13°02	N. 26·61	...	S. 47·0	S. 42·3	N. 50·0

Trincomali, Ceylon:
1905 *April* 10.

A Suspected Instance of Sudden Change on Jupiter.

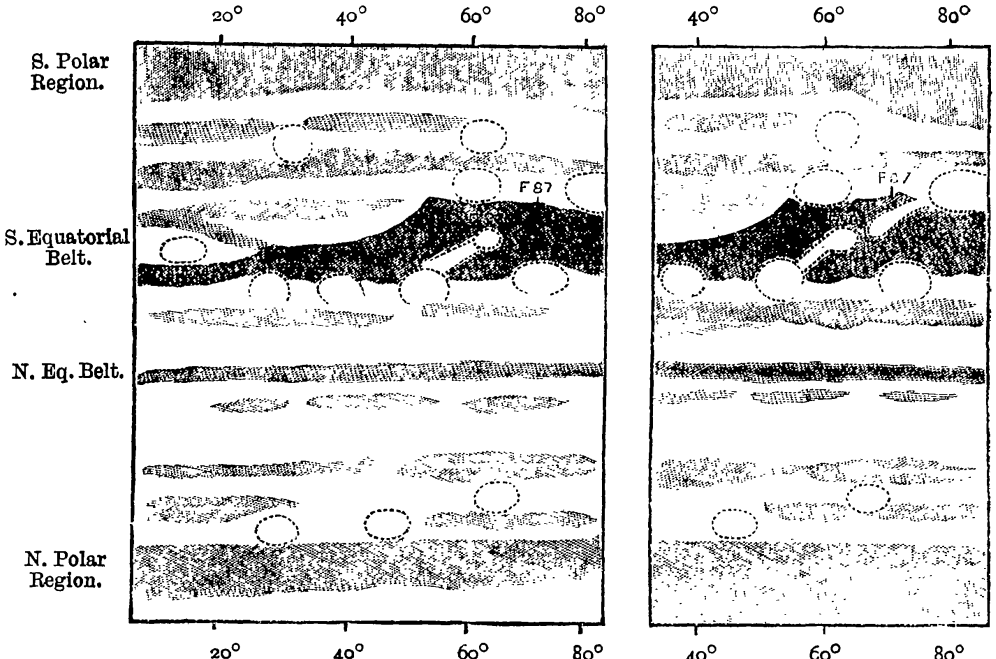
By Major P. B. Molesworth, R.E.

A most curious and unique observation was made here 1903 December 17.

I quote from the observing notes :—

"The dark spot F87 (in the S. edge of S. equatorial belt) crossed the C.M. under almost perfect definition at $7^h\ 10^m{\cdot}5$ L.T. ($1^h\ 45^m{\cdot}5$ G.M.T.). The surroundings were carefully entered on the sketch (No. 128) and the neighbourhood presented the appearance shown there.

"At $7^h\ 25^m$ L.T. (2^h G.M.T.) I suddenly noticed a minute bright white spot, like i just after ingress, on the S. edge of the S. equatorial belt immediately preceding F87. I thought it very strange that I should have omitted to take the transit of such a prominent spot or to show any indication of it on the sketch. At $7^h\ 28^m$ L.T. ($2^h\ 03^m$ G.M.T.) it was



No. 128.—Longitude (System ii.). About 1·45 G.M.T.

No. 128 a.—Longitude (System ii.). About 2·05 G.M.T.

very evident, and could not have escaped the most casual scrutiny. Between 7^h25^m and 7^h30^m L.T. (2^h—2^h05^m G.M.T.) its visibility fluctuated a good deal. This was not due to any fault in the definition, which was very sharp the whole time. By $7^h\ 30^m$ L.T. ($2^h\ 05^m$ G.M.T.) the bright spot had extended as a short bright rift for some distance into the belt, its north preceding end being only separated by a